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Test 564: Ferguson Model TO-35

Nebraska Tractor Test Lab

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The Experiment Station
University of Nebraska College of Agriculture
W. V. Lambert, Director, Lincoln, Nebraska

Department of Agricultural Engineering
Dates of test: October 10 to October 17, 1955
Manufacturer: MASSEY-HARRIS-FERGUSON INC.,
DETROIT, MICHIGAN
Manufacturer's rating: Not rated

NEBRASKA TRACTOR TEST NO. 564

FERGUSON TO-35

BELT HORSEPOWER TESTS

Hp	Crank shaft speed rpm	Fuel Consumption			Water used gal per hour	Temp Deg F		Barometer inches of mercury		
		Gal per hour	Hp-hr per gal	Lb per hp-hour		Cooling med	Air			
TEST B—100% MAXIMUM LOAD—TWO HOURS										
33.24	2001	3.089	10.76	0.569	0.00	167	64	28.940		
TEST C—OPERATING MAXIMUM LOAD—ONE HOUR										
31.82	2000	2.761	11.52	0.531	0.00	159	66	28.900		
TEST D—RATED LOAD—ONE HOUR										
29.29	1999	2.630	11.14	0.550	0.00	159	66	28.890		
TEST E—VARYING LOAD—TWO HOURS (20 minute runs; last line average)										
29.24	1995	2.625	11.14	0.550	...	160	67		
1.80	2121	1.117	1.61	3.800	...	116	67		
15.29	2075	1.861	8.216	0.746	...	112	64		
30.73	1868	2.635	11.66	0.525	...	149	62		
7.71	2094	1.430	5.39	1.136	...	115	60		
22.50	2042	2.268	9.92	0.617	...	117	57		
17.88	2032	1.989	8.99	0.681	0.00	128	63	28.875		
TORQUE (At Dynamometer)										
Eng rpm	1997	1865	1739	1619	1490	1363	1230	1122	994	867
Lb-ft	198.1	204.8	210.0	217.0	221.6	221.4	221.6	217.9	212.3	207.6
Dyn rpm	842	786	732	682	627	574	518	473	419	365

DRAWBAR HORSEPOWER TESTS

Hp	Draw bar pull lb	Speed miles per hr	Crank shaft speed rpm	Slip of drive wheels %	Fuel Consumption			Water used gal per hour	Temp Deg F		Barometer inches of mercury
					Gal per hour	Hp-hr per gal	Lb per hp-hr		Cooling med	Air	
TEST H—RATED LOAD—TEN HOURS—4th Gear											
23.67	1922	4.62	2006	6.34	2.384	9.93	0.617	0.00	154	55	28.893
TEST F—100% MAXIMUM LOAD											
30.51	2516	4.55	2000	7.49	4th gear				168	66	28.980
TEST G—OPERATING MAXIMUM LOAD											
9.20	3409	1.01	1992	17.29	1st gear (part throttle)				110	67	28.940
13.90	3414	1.53	2000	17.12	2nd gear (part throttle)				110	67	28.940
26.56	3400	2.93	2004	13.32	3rd gear				163	67	28.970
29.07	2380	4.58	2002	6.98	4th gear				165	67	28.980
28.54	1519	7.05	1999	4.36	5th gear				162	67	28.950
21.04	593	13.31	2004	1.70	6th gear				160	67	28.950
TEST J—OPERATING MAXIMUM LOAD											
20.00	1790	4.18	2002	16.75	4th gear (part throttle)				153	68	28.680
TEST K—OPERATING MAXIMUM LOAD											
17.17	1587	4.06	2003	16.72	4th gear (part throttle)				156	69	28.680

TIRES, WHEELS AND WEIGHT

	Tests F, G & H	Test J	Test K
Rear wheels			
Type	Pressed steel	Pressed steel	Pressed steel
Liquid ballast	113 lb each	None	None
Added cast iron	834 lb each	None	None
Rear tires			
No. and size	Two 11-28	Two 11-28	Two 10-28
Ply	4	4	4
Air pressure	12 lb	12 lb	12 lb
Front wheels			
Type	Pressed steel	Pressed steel	Pressed steel
Liquid ballast	None	None	None
Added cast iron	89 lb each	None	None
Front tires			
No. and size	Two 6.00-16	Two 6.00-16	Two 6.00-16
Ply	4	4	4
Air pressure	28 lb	28 lb	28 lb
Height of drawbar	22 inches	23½ inches	22 inches
Static weight			
Rear end	3670 lb	1776 lb	1726 lb
Front end	1320 lb	1142 lb	1140 lb
Total weight as tested with operator	5165 lb	3093 lb	3041 lb

FUEL, OIL and TIME Gasoline Octane No. ASTM 80.1 Research 85.7 (rating taken from oil company's typical inspection data) Weight per gallon 6.125 lb OIL SAE 10-20-30 To motor 1.259 gal Drained from motor 1.242 gal Total time motor was operated 41½ hours.

CHASSIS Type Standard Serial No. 157535 Tread width rear 48" to 76" front 48" to 80" Wheel base 72" Hydraulic control system constant running—transmission driven Advertised speeds mph first 1.23 second 1.84 third 3.37 fourth 4.90 fifth 7.36 sixth 13.49 reverse 1.64 & 6.55 Belt pulley diam 9" face 6½" rpm 1356 Belt speed 3100 fpm Clutch dual dry disc operated by single foot pedal Seat upholstered bucket seat Brakes expanding double shoe operated by two independent pedals on right hand side of tractor Equalized by springs and locking brakes together Power take-off constant running—controlled by secondary clutch.

ENGINE Make Continental Type 4 cylinder vertical Serial No. Z134 600323 Crankshaft mounted lengthwise Head I Lubrication pressure Bore and stroke 3 5/16" x 3 3/8" Rated rpm 2000 Compression ratio 6.60 to 1 Displacement 134 cu in Port diameter valves inlet 1½" exhaust 1" Governor variable speed centrifugal Carburetor size ¾" Ignition system battery Starting system 6 volt battery Air cleaner oil washed wire mesh Muffler was used Oil filter replaceable waste packed element Cooling medium temperature control thermostat.

REPAIRS AND ADJUSTMENTS No repairs or adjustments.

REMARKS All test results were determined from observed data and without allowances, additions or deductions. Tests B and F were made with carburetor set for 100% maximum belt horsepower and data from these tests were used in determining the horsepower to be developed in tests D & H, respectively. Tests C, D, E, G, H, J, & K were made with an operating setting of the carburetor (selected by the manufacturer) of 96.0% of maximum belt horsepower.

HORSEPOWER SUMMARY

	Drawbar	Belt
1. Sea level (calculated) maximum horsepower (based on 60° F. and 29.92" Hg)	31.68	34.50
2. Observed maximum horsepower (tests F and B)	30.51	33.24
3. Seventy-five per cent of calculated maximum drawbar horsepower and eighty-five per cent of calculated maximum belt horsepower (formerly ASAE and SAE ratings)	23.76	29.33

We, the undersigned, certify that this is a true and correct report of official tractor test No. 564.

L. F. LARSEN
Engineer-In-Charge

L. W. HURLBUT
G. W. STEINBRUEGGE
J. J. SULEK
Board of Tractor
Test Engineers

EXPLANATION OF TEST REPORT

TEST A: The manufacturer's representative operates the tractor for a minimum of 12 hours using light to heavy drawbar loads in each gear.

This serves as a period for limber up, general observation and adjustments. Adjustments that are permissible include valve tappet clearance, breaker point gap, spark plug gaps, clutch and others of a similar nature. No new parts or accessories can be installed without having mention made of it in the report.

No data are recorded during this preliminary run except the time that the engine is operated.

BELT HORSEPOWER TESTS

TEST B: The throttle valve is held wide open and the belt load on the dynamometer is adjusted so that the engine is at the rated speed recommended by the manufacturer. Carburetor, ignition timing and manifold adjustments are all set for maximum engine power.

This test is designed to determine maximum belt horsepower of the tractor at rated speed and to measure fuel consumption at the maximum power on the belt.

TEST C: For tractors with carburetors the best fuel economy does not always occur when the engine develops maximum power at rated speed. Test C is intended to allow the manufacturer's representative to select a more economical fuel setting even though there is a slight loss of power. *This more practical carburetor setting is used in all later tests except test F.* The throttle valve is held wide open and load adjusted to give rated rpm. Tests B and C are the same for diesel tractors, which have an altogether different fuel system.

TEST D: The throttle control lever is set so that the governor will maintain rated engine speed when rated load is applied. Rated load is 85% of 100% maximum, as obtained in test B, corrected to standard conditions.

This rating is somewhat less than the maximum belt horsepower in order that the operator may have a certain amount of reserve.

TEST E:

Varying load serves to show the range of engine speeds when the engine is controlled by the governor during the following varied loads, of 20 minutes each: rated load, no load, $\frac{1}{2}$ rated load, maximum load at wide open throttle valve, $\frac{1}{4}$ and $\frac{3}{4}$ rated load.

The average result of this test shows the average power and fuel consumption. Since the average tractor is subjected to varying loads, these data serve well in predicting fuel consumption and efficiency of a tractor in general use.

Torque, lb-ft at dynamometer, is obtained with wide open throttle and sufficient load is applied to give several readings.

DRAWBAR HORSEPOWER TESTS

In all drawbar tests the pull exerted by the tractor is transmitted by a hydraulic pressure cylinder to a recording instrument in the test car. All tests are made on the same dirt test course which is maintained by grading, sprinkling and rolling

so that it remains very nearly the same throughout the season. The same tires, wheels and weights are used for all tests except J and K.

TEST F: A drawbar test, the results of which are used to determine the rated drawbar horsepower in test H. The carburetor is set to develop maximum power as in test B. The rated gear recommended by manufacturer as plow gear is used in this test. The drawbar load is adjusted to give rated engine speed.

TEST G: Maximum drawbar horsepower is determined in each gear when the carburetor is set for fuel economy as in test C. The throttle valve is held wide open and the load is applied so that the engine runs at rated engine speed.

When operating in low gear it is not uncommon for the tractor to develop less drawbar horsepower than in rated gear because of excessive wheel slippage. When excessive wheel slippage occurs the load is reduced until slippage approaches 16%. When the load is reduced it is necessary to operate the tractor engine at part throttle and control engine speed by governor action.

TEST H: Intended to test the ability of the tractor to run continuously for 10 hours at rated drawbar horsepower and to determine the fuel consumption during that time. Rated drawbar horsepower is 75% of 100% maximum drawbar horsepower (Test F), corrected to standard conditions.

When operating at rated load the throttle control lever is set to maintain rated engine speed. This rating is less than maximum drawbar horsepower in order that the operator may have a certain amount of reserve.

TEST J: The tractor is operated in rated gear with all added weight removed. This test shows the effect of the removal of added weight on the performance of the tractor when compared with test G.

Removal of wheel weights generally increases wheel slippage and decreases drawbar horsepower.

TEST K: Similar to test J except that the smallest tires and lightest wheels offered by the manufacturer are used.

